Replace the paragraph beginning at page 2, number [0005] with the following rewritten paragraph:

A1 cont'd.

A special form of FQPSK described in U.S. Patent Nos. 4,567,602 and 5,491,457 , is known as FQPSK-B. This is a baseband filtered version of FQPSK which is more spectrally efficient than unfiltered FQPSK and thus is useful in limited bandwidth channels. However, the bandwidth limiting of FQPSK-B comes at the expense of bit error rate degradation caused by the introduction of intersymbol interference due to the baseband filtering.

Replace the paragraph beginning at page 2, number [0008] with the following rewritten paragraph:

A2

A trellis-coded interpretation of FQPSK is known. The FQPSK signal is generated by transmitting one of 16 different shaped waveforms. The basic waveform shapes are shown in Figure 1. Eight unique waveforms are shown in Figure 1. Eight other shapes, which are the negatives of those waveforms, are also used. These waveshapes characterize the 16 state trellis that represent the optimum Viterbi receiver for FQPSK (or FQPSK-B). A full-blown system of this type, while feasible, may be too complex for a commercial implementation.

Replace the paragraph beginning at page 3, number [0010] with the following rewritten paragraph:

The present application teaches a special Viterbi receiver that has reduced complexity but still has bit error rate advantages over a symbol-by-symbol detection type receiver. According to an embodiment, he waveforms forming the FQPSK-B signals are grouped in a special way to create a simpler trellis, i.e., one with fewer states. This receiver will still provide significant gain over conventional FQPSK-B receivers, while reducing the complexity that would otherwise be inherent in an optimum FQPSK-B Viterbi receiver.

Replace the paragraph beginning at page 4, number [0016] with the following rewritten paragraph:

Figure 5 shows a block diagram an embodiment of a simplified FQPSK-B receiver; and

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Replace the paragraph beginning at page 4, number [0018] with the following rewritten paragraph:

The present application invention defines a reduced complexity alternative system. This system forms a simplified FQPSK-B Viterbi receiver with a reduced number of correlators and trellis states. For example, the receiver may have a factor

of 4 fewer correlators in the receiver, and a factor of 8 fewer trellis branch computations.

Replace the paragraph beginning at page 4 number [0019] with the following rewritten paragraph:

In an embodiment, the 16 possible FQPSK-B waveforms are divided into 4 groups. Each group may include signals, for example, which have some similar characteristic. An FQPSK signal is received. This signal is correlated against the average of the waveforms in each group. The signals are appropriately grouped, as described herein, in a way that reduces the FQPSK trellis from a 16-state trellis with 4 transistions per state to two independent two-state trellises with only two transistions per state. Due to the similarity between the PQPSK-B waveforms, this reduced-complexity receiver only has a small E_b/N_0 penalty as compared with a full-blown Viterbi receiver. However, if offers significant performance gains as compared to the conventional FQPSK-B receiver. Special characteristics of this receiver are hence described.

A5 cont.

Replace the paragraph beginning at page 5, number [0020] with the following rewritten paragraph:

A traditional commercial FQPSK-B receiver includes a sample-and-hold receiver that carries out symbol-by-symbol detection. The received signal is downconverted to baseband. The baseband signal is then filtered using a detection filter. The output of the detection filter is sampled, and a decision on the transmitted signal is made.

Replace the paragraph beginning at page 5, number [0021] with the following rewritten paragraph:

A5 cont.

Intersymbol interference introduced by the input filter will increase the bit error probability of this receiver. Figure 2 shows a comparison between the 32 term theoretical approximation of bit error probability, and the computer simulated results. This is further compared with the bit error probability of ideal QPSK in the figure.

Replace the paragraph beginning at page 6, number [0022] with the following rewritten paragraph:

A traditional FQPSK-B Viterbi receiver is shown in Figure 3. This receiver correlates the baseband received signal with the 16 FQPSK waveforms, and uses the Viterbi. Algorithm (VA) to perform trellis decoding. The Viterbi algorithm searches along the translations between states of the FQPSK trellis to find the

path with the largest accumulated branch metric. The 16 Viterbi algorithm branch metrics Z_j are defined as follows:

$$Z_j = R_j - \frac{E_j}{2} \qquad j = 0,\ldots,15 \qquad (1)$$

where R_j is the correlation of the received signal and the jth waveform, and E_j is the energy of the jth waveform. The correlation values R_8 through R_{15} are obtained by taking the negatives of R_0 through R_7 respectively. For example, $R_0=R_8$. A total of 16 correlations are needed, with 8 correlators being needed for the in-phase signals and 8 correlators being needed for the quadrature phase signals. The "Viterbi algorithm" block 350 carries out the subtraction of $E_j/2$ from the value R_j.

Replace the paragraph beginning at page 6, number [0024] with the following rewritten paragraph:

A simplified FQPSK-B Viterbi receiver is described with reference to Figures 4 and 5. In this embodiment, sets of waveforms are grouped together in order to create a reduced trellis. In the embodiment, the waveforms C_0, C_1, C_2 and C_3, as represented by the top row in Figure 1, are grouped into a first group. As can be seen by investigating these waveforms, each of the waveforms have "similar" properties. A second group is formed of the second row in Figure 1, including the waveforms C_4, C_5, C_6, and C_7. For example, C_0-C_3 each represent waveforms which

have small or no deviation from a constant. Similarly C_4-C_7 represent waveforms which have small or no deviation from a sinusoid. That is, the waveforms within each group are spectrally similar, so that the combination (average) of these waveforms may also be spectrally similar to each of the waveforms being averaged. The third group of waveforms is formed from C_8-C_{11}, and a fourth group of waveforms is formed from C_{12}-C_{15}. This grouping enables the trellis-coded structure to be divided into two independent, in-phase and quadrature, two-state trellises.

A6 cont.

Replace the paragraph beginning at page 7, number [0025] with the following rewritten paragraph:

Figure 5 shows a block diagram of the modified receiver. The received signal 500 is filtered by 502 and demodulated by demodulator 504. The demodulated signals include an in-phase signal 508 and quadrature signal 509. The in-phase signal 508 is delayed a half symbol by delay element 507. The demodulated signal is correlated against the average of the waveforms in each group. Four correlators 510, 512, 514, 516 are used for this correlation. The average values are show in Figure 4, and obtained as:

Equations

Replace the paragraph beginning at page 8, number [0026] with the following rewritten paragraph:

Since q_2 and q_3 are respectively the negatives of q_0 and q_1. Only two q_2, q_3, q_0, q_1, correlators are needed for each of the I and Q channels. The same Viterbi algorithm metric is used in equation 1, except that E_j now represents the energy of the group average waveform $q_j(t)$.

AK concl.

Replace the paragraph beginning at page 8, number [0027] with the following rewritten paragraph:

Figure 6 shows a trellis including group signals with two states and two transitions per state. The dual Viterbi techniques for the I and Q channels can hence be combined into a single 4 state VA. Compared with the full Viterbi receiver, this simplified receiver may have 12 fewer correlators, and an eight-fold reduction in the number of Viterbi algorithm computations per decoded bit.